THE MARINE REVIEW

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IN PRAISE OF THE DREDGER.

An absorbingly interesting paper on "The Panama Canal" was read by M. Philippe Bunau-Varilla, at the Society of Arts, on Jan. 23. Having claimed that a straits of Panama was what ought to be constructed, he proceeded to discuss the means of making it. It was not sufficient, he said, to define the ideal type of communication between the oceans; it must also be practically realizable. Now, with the means generally employed, with those used by the company presided over by M. de Lesseps during almost the entire duration of its existence, with those employed by the second Panama company, the new company, with those that the American government was employing at the present day, such a conception was radically chimerical. In the three cases quoted the organ of excavation was the excavator or steam shovel, rolling on rails; the organ of transportation and dumping of the spoils was the car, rolling on rails. With this method, the method in the dry, the difficulties caused by the diluvian rain, in the preservation of the railroad tracks, were enormous. It was necessary for a relatively feeble production to have a considerable number of workmen in constant attendance. Accidents and running off the rails occurred incessantly, because in a vast excavation work the tracks often had to be shifted to follow the terraces. Consequently they could neither be well fixed, nor well ballasted, nor well drained. These necessities, combined with the brusque and violent tropical rain, the bad quality of the workmanship in that country where depression and fever were rife, and the clayish and slippery nature of the soil of the isthmus, ended in running off the rail, in accidents which occurred over and over again, and which were the great, the only and the essential difficulty of the excavation of the Panama canal.

The estimates prepared by the isthmian canal commission, the American official authority entrusted with the execution of the Panama canal, gave, in September, 1905, as the cost of the sea-level canal excavated in the dry, the following figure, $321,779,731. This valuation comprised $7,000,000 for the tidal locks, and $10 394,794 for the masonry walls at Culebra, an erroneous conception, since entirely abandoned. It might, therefore, be said that by overlooking these two elements of the work, the estimated cost of digging a lockless sea-level canal, 35 ft. deep and 150 ft. wide, was, in 1905, in round figures, $300,000,000. These figures were arrived at by the official American commission after six years of study, and two years of effective work under its own management in the isthmus. The length of time for the execution of this canal was estimated at more than twenty years by the commission in 1901, and in 1905 one might conclude from the documents of the commission that it allowed twenty-two years.

The volume of the excavations to be extracted for the sea-level canal thus conceived, having 35 ft. depth below mean level from the origin on the Atlantic to Miraflores, K. 62, and 45 ft. depth below mean level from Miraflores to the Pacific end, K. 75, with 150 feet bottom width, lateral slopes of 45 degrees and bermes of 50 ft. on each side of the canal at 10 ft. above the water, was 205,000,000 cubic yards. The volume of the navigable highway that he had called the "Straits of Panama," with an average depth of 50 ft. below mean tide (45 at Colon, 55 at Panama), the width at the bottom being 500 ft., slopes at 45 degrees, and bermes of 100 ft. on each side, was about 600 000,000 cubic yards. The completion of the "Straits" would necessitate, roughly speaking, an outlay three times greater than that of the sea-level canal. According to the isthmian canal commission's own figures, it would be necessary to spend $900,000,000, and to wait about 60 to 70 years to see the first vessel pass through it. Such figures explained sufficiently why the rational and complete solution of the Panama problem, the opening of a waterway unobstructed by locks, having free openings on the two oceans sufficiently wide to allow ships to navigate and to pass each other without being inconvenienced by the tidal and fluvial currents, had never been examined or discussed before September, 1905, when he submitted it to the international consulting board which met at Washington. If he acted thus, is was not for the vain satisfaction of fixing a theoretical and chimerical term to the efforts of the engineers. In showing them the enviable and desirable end he showed at the same time the practical way to reach it. Since 1879, when the first international congress was assembled by M. de Lesseps, until 1905, when the last one was assembled by Mr. Roosevelt, all the numerous commissions by whom the Panama canal was discussed, had, without exception, forgotten one thing. That was the most important, the essential question—the mode of execution.

All these commissions had admitted as implicit truth, as an axiom, that the Panama canal would be excavated dry. They then discussed the maximum and minimum form compatible with this mode of execution from the narrow level canal closed by tidal locks on the Pacific side to the lock canal with a summit level, more or less high, in the center of the isthmus. Now that particular mode of execution was not the only one as the various commissions had thought. The excavation, transportation, and dumping might be

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effected in the dry, on rails, but it might also be effected on water. The excavation in the dry was not the only mode of excavating—it was also the worse, and more expensive and the poorer one. The defects which existed in temperate regions increased in incredible proportions under the climatological conditions of the Panama isthmus. With the excavation by floating dredges, transportation by barges and dumping in deep water, all the isthmus difficulties vanished as if they had been touched by a magician's hand.

There was no more need of an enormous army of workmen, changing every minute some of the tracks, in order to follow the progress of the earthwork. There was no more need for the ceaseless care to be taken with the moveable tracks, which had necessarily poor foundations and could not be disposed for supporting any heavy traffic. There was no more need for struggling against the sudden tropical floods, which brought down on the tracks the mud torn up from the slopes of the cut, submerged them, ruined their foundations or buried them. There was no more need of stopping series of steam shovels for the frequent runnings off the rails, which these unavoidable conditions of the soil and climate brought about constantly, blocking for whole days communication between the points of loading and points of unloading. There was no more need to struggle against the landslips which stopped the excavation work, and when they took place on the lines of communication paralyzed by repercussion both a considerable plant and a great number of hands. There was no more need to tax one's ingenuity to enable the trains to circulate over the dumping places where the rain caused frequent landslips. There was no more need for hesitation between this Scylla and the Charybdis, which was either to have heavy trucks and powerful locomotives for excavating huge masses of earth which demanded the heavy penalty of more frequent runnings off the rails, so difficult to keep in order, or to have lighter plant circulating more easily, but less powerful and carrying away insufficient masses. There would be no more need of exposing to the alternative sun and rain thousands of workmen who were struggling against nature, and consequently of enduring the sorrowful procession of fevers and pneumonia which resulted from that inhuman work.

With the excavation on water by dredges, transportation on water by barges, and dumping into deep water by opening traps at the bottom of the barges, all these difficulties vanished. The carriage power of water was unlimited, and the most powerful organs for excavation might be employed without any drawback. As a matter of fact, dredges with buckets of one cubic yard (764 liters) were at present in use. As there were fifteen passing per minute they were capable of bringing up from the bottom more than 22,000 cubic yards in a day of 24 hours. Making a very liberal allowance for stoppages and other causes of diminution of work, the most pessimistic of dredgers would not figure for one of these instruments on an effective yielding of less than 7,000 cubic yards measured in the excavation. And dredges of that capacity were not the most powerful ones. There were some in Great Britain which had buckets of about 2 cubic yards, that was, which could give a useful and practical yield of 14,000 cubic yards per day, in the most unfavorable circumstances. With the transport by water a barge could easily carry 2,000 tons of material, that was about 1,000 cubic yards of the heaviest ground measured in the excavation, and even more. The number of hands on board a dredge doing this enormous work would be fifteen men if it was a steam dredge, and ten men if it were worked by electricity. On board a barge there would be two or three. The dumping was automatic, and only required the action of gravity. That admirable and complete solution of all the isthmian difficulties was reflected naturally in the cost price.

"OLD IRONSIDES."

It develops that the old naval frigate Constitution, which is now being restored to her original form at the Boston navy yard, will probably not be sent to the Jamestown Exposition if the influence of various patriotic societies of Massachusetts can prevent, owing, it is said, to the belief that if she once leaves Boston it will be almost impossible to get her back. The historic vessel looks today almost as she must have when she was launched in Boston in 1797, this having been made possible by the finding of the model carved by one of her designers. Duplicates of her battery are now being cast at the Boston navy yard but they are duplicates only in appearance, not being fitted for service.

One relic of great historic interest has been discovered in the ship's bell taken by the Constitution from the British frigate Guerriere, which was blown up by the Constitution Aug. 20, 1812. Many other relics have come to light since the act of congress was passed appropriating $100,000 to the work of restoring the veteran fighter.

OFFICERS STRIKE.

The American Association of Masters, Mates and Pilots, which recently ordered a strike for May 1, has succeeded in making agreements with the majority of the coastwise lines, although not succeeding in all cases in procuring the demands first set forth. The lines which are yet to be settled with include the Atlantic Coast Lumber Co., Guffey Oil Co., Standard Oil Co., American-Hawaiian and Southern Pacific lines. Including those lines which constitute the Consolidated Steamship lines, the following have concluded agreements with the officers: Clyde, Mallory, Metropolitan, Eastern Steamship, Hudson Navigation, Citizens', Ward, Savannah, Morgan, Bull, Brunswick, Panama, Red D, and Luckenbach Towing & Transportation Co.

LONGSHOREMEN STRIKE.

Longshoremen to the number of 10,000 are on strike at the New York docks for an increase in wages. The companies affected include the Red Star, White Star, American, Holland-American, Phoenix, Rotterdam, Scandinavian-American, North German Lloyd, Bremen, Ward, Mallory, New York & Porto Rico, and Munson lines, and a number of freight handling firms, including the Bush Co., Charles N. Tiffany, and the New York Dock Co., these latter having been affected through a strike of their freight handlers who have struck in conjunction with the longshoremen. The Cunard line is also threatened with a strike and many expedients are being resorted to in order to load and unload vessels, many crews and clerks helping out in the emergency. Later advices seem to indicate the settlement of differences insofar as the coastwise and West India lines are concerned.

The United States lighthouse tender Madrone has just landed at the Tarellones island's light station and fog signal a complete oil-burning outfit to be used in operating the fog signal machinery. The United States lighthouse board came to the conclusion some time ago that a supply of steam could be maintained with greater certainty by using liquid fuel than with coal. The Tarellone fog signal consumes about 100 tons of coal a year. It is estimated that by substituting crude oil for coal, a considerable saving may be effected.

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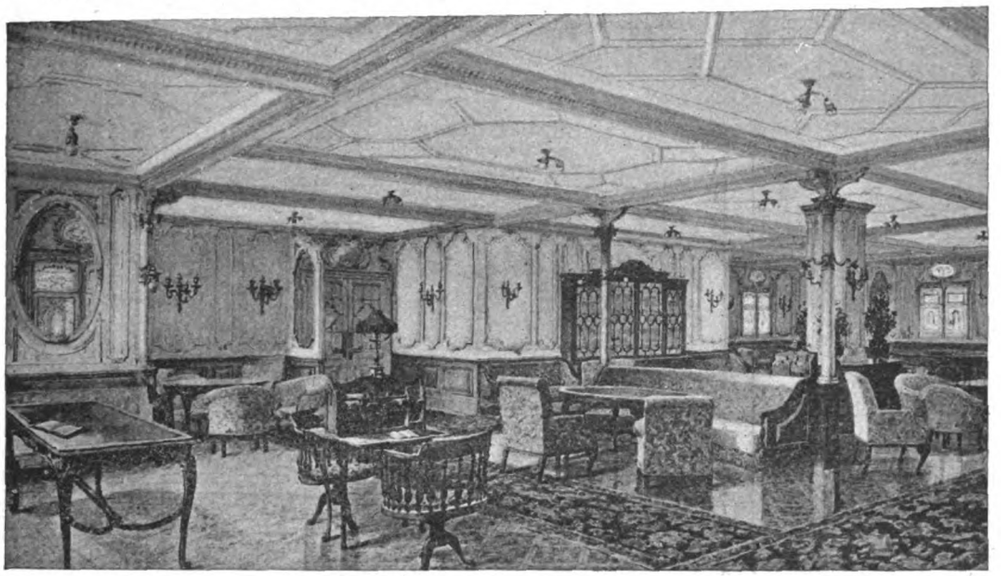
WHITE STAR LINER ADRIATIC.

The White Star liner Adriatic, the latest product of the great ship yard of Harland & Wolff, Belfast, reached New York last week in her maiden trip. The Adriatic is 725 ft. 9 in. long, with 75 ft. 6 in. beam, and is about 50 ft. deep, while her gross tonnage is nearly 25,000, and her displacement over 40,000 tons. She is divided into twelve water-tight compartments, and has nine steel decks, while the double bottom extends through the whole length of the hull, thus adding a special element of safety, and the water-tight doors are upon the latest and most approved principle. The ship is very strongly framed and the total number of plates used in the construction was close on 20,000, while the rivets used are estimated at two-and-a-half millions. The anchors weigh about 8 tons each, and are worked by powerful gear, the cables being 3⅛ in. in diameter, and weighing about 90 tons. There has been a very careful consideration of the distribution of weights in the vessel so that she may steam easily in any seaway. The arrangements on board are such that the ordinary passenger is generally unconscious of the mighty energy which drives the vessel through the water, but the engines are of great power, and consist of two sets of the quadruple expansion type arranged on the "balanced" principle, which is so advantageous in preventing vibration.

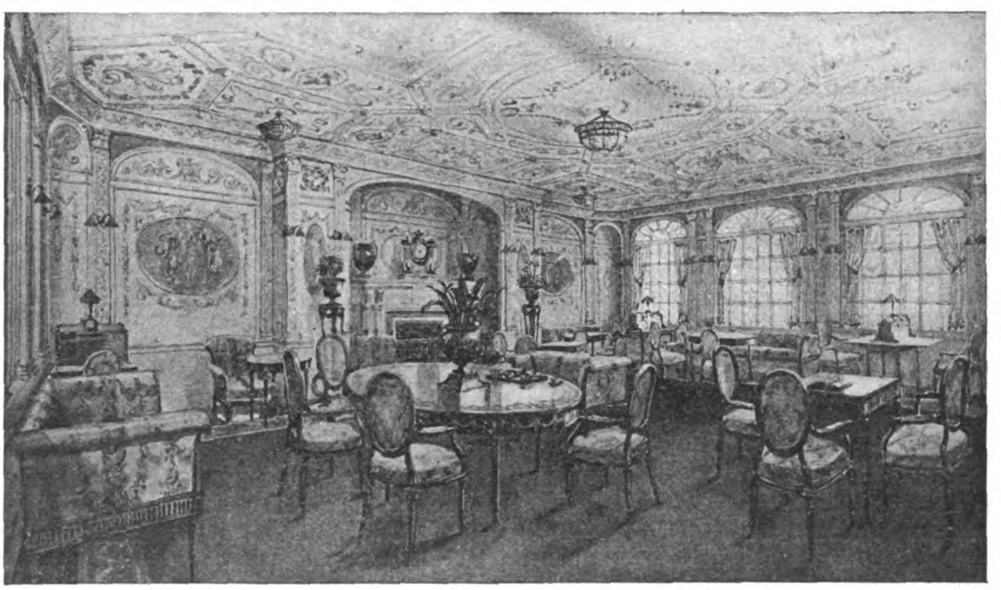
Generally, it may be said that the arrangements on board resemble those which have been so much appreciated in the great ships of the White Star line, such as the Oceanic, Celtic, Cedric, Baltic, and others, with the additions and improvements which shall presently be described. There is the same strength and seagoing efficiency, but greater roominess, with every evidence of luxury and taste in adornment and fittings. The amount of head-room is unusual, and the spaciousness of the entrances, apartments, and suites, and the width and length of the breezy promenades are a very notable feature in the new vessel. As in the other steamers of the class, a continuous shade deck runs fore and aft, with three tiers of deck houses, and three promenade decks alongside them.



THE LOUNGE.

The state rooms are lofty, well lighted, and admirably ventilated, all the arrangements having been facilitated by the great beam of the vessel and the height between the various decks. It has thus been possible to provide rooms of exceptional size, and the accommodation for the first-class passengers is unsurpassed and unequaled. The second-class accommodation is immediately abaft the first-class, and partakes of many of the advantages which the latter possesses, while the third-class passengers are provided for abaft the second class, and to a certain extent at the forward end of the vessel.

It is, of course, in the first-class accommodation that the amenities and advantages of the new ship are largely to be found, and that the artistic character of the adornment and internal fittings is most fully displayed. And here it must be remarked as a noteworthy fact that the Adriatic has a very large num-



THE READING AND WRITING ROOM.

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ber of first-class single berth rooms—seventy-six—this being a feature which travelers will greatly appreciate. No steamer is anything like so well provided in this respect. In this part of the ship the utmost endeavor has been made by the managers of the line to meet the wishes and minister to the comforts of travelers. The arrangement is luxurious, and the elegant style distinguishes alike the numerous cabins, the many separate and distinct suites of apartments, and the state-rooms and public accommodation for first-class passengers. The rooms have extra wide beds, writing tables, wardrobes and other facilities, and the decorations consist of small white panelings, imparting a bright and cheerful character. The effect of the decoration and upholstering is light, pleasing and artistic, and the care which has been bestowed on the arrangements extends to the bathrooms, which are very numerous and conveniently fitted, and the other facilities of the vessel.

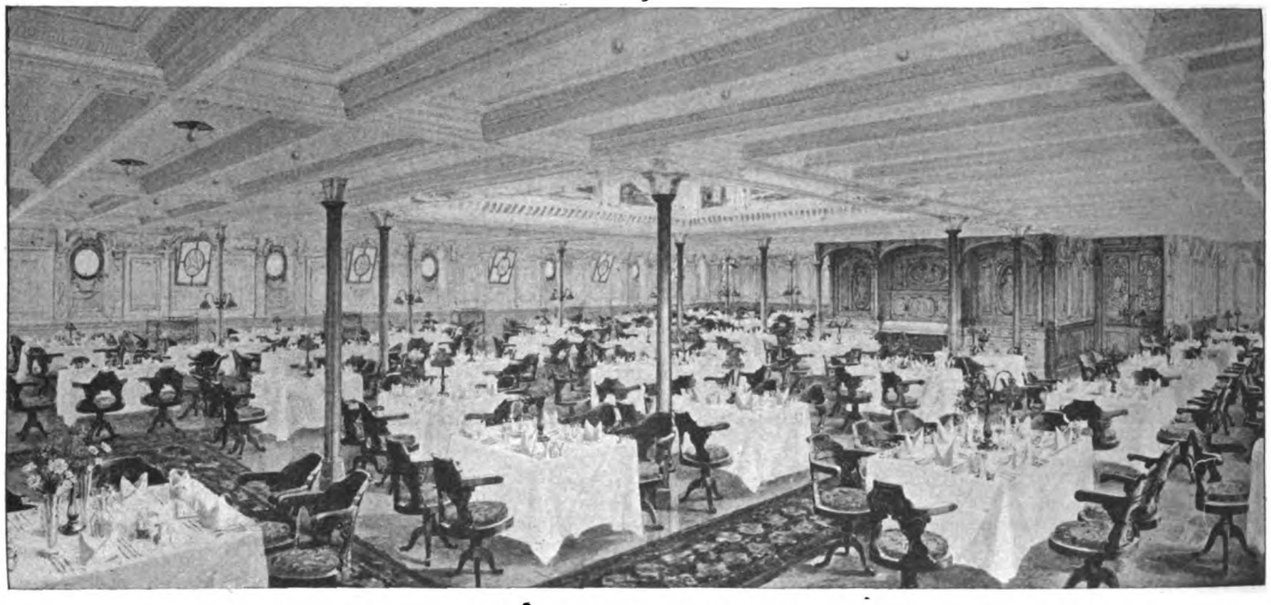
But the great feature of the first-class accommodation, apart from the large number of single-berth rooms, is the splendid comfort of the great public apartments—the grand first-class dining saloon, the reading and writing room, the lounge, and the smoking room. These are illustrated, but it should be noted that in the scheme of decoration over-elaboration and rococo adornment have been avoided.

The first-class dining saloon is a magnificent apartment distinguished by its rich scheme of decoration and the size and spaciousness which it possesses. It is situated on the upper deck, and extends the full width of the ship, an arrangement which has made it possible to construct the saloon on an exceptionally airy and spacious plan, and it contains seating accommodation for about 400 people. This accommodation, it may be remarked, is unlike the old-fashioned system still existing in other vessels, the arrangement being that of separate tables, so that parties may dine together in the manner now so much favored. The style of the apartment is Jacobean, and the general tone is a delicate ivory white, with charming lighting arrangements and the most exquisite of metal fittings.

The reading and writing room is on the boat deck, and is another attractive apartment where passengers are likely to spend a good deal of the time which is not passed in the open. The apartment is spacious, and the effect is heightened by the scheme of decoration in delicate color, consisting of panels and ornaments in low relief, the panels filled with paintings of the graceful and imaginative school of Boucher, Bartolozzi and Cipriani.

The lounge is another magnificent apartment, and is also situated on the boat deck. It is a place to which both ladies and gentlemen resort, to enjoy cards, music, tea, coffee, or other things they fancy, and smoking and liquors are here provided. The room is paneled in oak of delightful color, and there is a ceiling appropriate and admirable. Here also there are writing tables and all things that the lounger is likely to require. The seating accommodation is of the most comfortable type, and for ladies there are work tables, while cosy corners have been arranged for conversation, tea, or cards. The lounge is as delightful a place as is the reading and writing room, or the smoke room, to enjoy a book from the well-selected library.

The smoke room, the special preserve of the men, is of rich, warm, and comfortable character. The walls are lined with figured leather of harmonious hue and character, forming a background for pictures illustrative of famous events in British naval history. Deep seats, luxuriously upholstered, invoke the lover of the weed to the contented enjoyment of his pipe or his cigar, his glass, and his game of cards. The quiet note of this room is that of sober richness imparted by the figured leather of the walls and the rich hue of the mahogany, and brown leather covering of the seats. The windows are of rich and mellow tone, in stained glass, adding to the effect and increasing the charm.



THE FIRST-CLASS DINING SALOON.

In order to facilitate communication between the various levels, an electric lift runs from the first-class entrance on the boat deck to the dining saloon on the upper deck, thus serving the boat deck and the upper deck, as well as the promenade deck and the upper promenade deck. Another new feature is a large gymnasium, provided with an ample supply of apparatus, so that the passenger may keep himself "fit" during his sojourn on board. Other notable innovations are in the character of the bathing arrangements, and particularly in the provision of Turkish baths. It is now long since this ancient class of bathing was introduced into this country, and it has since undergone many extensions in style and method. Now it is interesting as well as significant to find that in the most popular vessel on the Atlantic Turkish baths have been provided for the advantage of passengers. They con-

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sist of the usual hot, temperate and cooling rooms, with shampooing rooms, a plunge bath, and massage couches. It is likewise worthy of remark that three electric baths have been provided. The photographer's dark room, which will always be available during the voyage, is another feature sure to be highly appreciated by tourists.

NEW STEAMER COLUMBIA.

The handsome new steel steamer Columbia, built by the New York Ship Building Co., Camden, N. J., for the Baltimore and Norfolk service of the Chesapeake Steamship Co., was placed in commission at the opening of the Jamestown Exposition. The dimensions of the Columbia are as follows: Length over all, 285 ft.; length between perpendiculars, 250 ft.; beam 46 ft.; depth of hold, 17 ft., 4 in.; gross tonnage, 2,582; net tonnage, 1,673. The hull is built entirely of steel, and the vessel has been built in strict accordance with the rules of the American Bureau of Shipping for class A1, 20 years, in the "Record of American & Foreign Shipping." The scantlings and details of construction have been designed with the idea of making her the strongest vessel of her class and also to eliminate all vibration, and she has proved that this idea can be worked out successfully.

The Columbia is propelled by a single screw, driven by a four-cylinder triple-expansion engine, the cylinders being 26, 41, 50 and 50 in. in diameter, by 42-in. stroke. Steam is supplied by four boilers, each 13.7 by 12 ft., built for a working pressure of 180 pounds.

GREAT LAKES RED BOOK.

The Great Lakes Red Book is now out for 1907. The edition is the most complete that the MARINE REVIEW has ever published, containing a list of all vessels, active on the lakes, with the names of their masters and engineers, and the names and addresses of their owners, together with the carrying capacity of the vessels in gross tons. No more serviceable compendium of information concerning an industry was ever published. Orders for this book can now be filled by the Penton Publishing Co.

NEW STEAMER FOR R. O. & A. B. MACKAY.

The vessel under construction at the Bridgeburg yard of the Canadian Ship Building Co. for the St. Lawrence & Chicago Steam Navigation Co., Toronto, is reported 85 per cent completed. Material is now arriving for the new vessel which the Canadian Ship Building Co. will construct for R. O. & A. B. Mackay, of Hamilton, Ont. This vessel is of the arch type with an improved method of construction of the tank top. The dimensions are: Length over all, 460 ft.; length over stem and stern post, 440 ft.; beam, molded, 53 ft.; depth, molded, 29 ft.; engines quadruple-expansion. Robert Curr, naval architect, will supervise her construction for the owners.

SAILING DIRECTIONS.

The attention of owners and masters is directed to the fact that the hydrographic office has issued new sailing directions for Lake Superior and Lake Michigan. These directions have been thoroughly revised and are complete to date, containing in addition special reference to compass work and the compass ranges latterly established on the lakes. Every shipmaster on the lakes should have a copy of each of these publications for the safe navigation of his vessel. In addition every passenger steamer should have one available as a guide book and book of reference for the passengers aboard, for in addition to the sailing directions they contain complete descriptions of the towns situated on the lakes with their populations and industries. These books are for sale by the MARINE REVIEW.

NEWFOUNDLAND TRANS-ATLANTIC SERVICE.

It is expected that the contract with the Newfoundland government for the new fast Atlantic service from Great Britain to Canada and the United States, via Newfoundland, will pass the colonial legislature during the present session. The terminal port will be at London, Southampton, Liverpool or Glasgow and not any port in Ireland as has been frequently said. If it is so desired, however, it can be arranged that the mails be landed at Killery bay or some other port on the west coast of Ireland.

The contract provides for the employment of three Atlantic steamers of 5,000 tons gross and a speed of 17 knots but it is intended to use vessels both larger and faster. From Killery bay, where the steamers would stop only long enough to pick up or discharge mails, the vessels would proceed to Green bay, which is called Notre Dame bay on the maps, on the northeast coast of Newfoundland, 200 miles north of St. Johns, which is a distance of 1,700 miles from Killery bay. The 17-knot steamer would reach Green bay in just over four days and would again remain only long enough to land passengers and mails, after which she would proceed to St. Johns and thence to some other port, either in Canada or the United States. It is estimated that by the inauguration of this service, even with 17-knot boats, Quebec would be reached from London in less than six days, a saving of nearly a day on the present average time. New York would be reached from London in six days and twelve hours, the record from land to land now being six days. Chicago would be reached in seven days, a clear saving of a day. In the case of Newfoundland it would be a saving of four to five days over the present service.

With the employment of boats similar to those now running on the fastest New York service, the times, after allowing for trans-shipment, would be as follows: Quebec, four days, 13 hours; Chicago, five days, 14 hours; New York, five days, four hours. The strategic value of the line lies in the fact that when the fastest steamers are put on the new service the all-British route through Canada to the far east would be shortened by some forty-eight hours, as compared to the existing routes.

NEW ENGLAND NAVIGATION CO.

The New England Navigation Co., controlled by the New Haven road, and incorporated under the laws of Connecticut, has filed with the Massachusetts secretary of state a statement of financial condition, dated Dec. 31, 1906:

ASSETS.	
Real estate and machinery	$ 9,297,936
Material	188,969
Cash and debts receivable	5,755,502
Total	$15,242,408
LIABILITIES.	
Capital stock	$ 5,000,000
Accounts payable	1,377,524
Debenture indebtedness	6,775,000
Surplus, P. & L.	2,089,883
Total	$15,242,408

Another of Great Britain's formidable fighters was floated recently when the armored cruiser Invincible was launched from the Elswick shipyard. She is one of the trio of largest cruisers in the world of which the first, the Indomitable, was launched March 16. The greatest secrecy was observed regarding the details of the new warship. Her dimensions are the same as the Indomitable, namely: 17,250 tons displacement, 530 ft. in length, exceeding the older armored cruisers by 50 ft. She has turbine engines and is expected to attain the high speed of 25 knots an hour. The armament of the cruisers includes eight 12-in. guns, almost equaling the main battery of the Dreadnought.

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THE NEW STEAMBOAT INSPECTION RULES.

It is probable that not in many years have the Board of Supervising Inspectors succeeded in framing rules that will arouse such general and determined opposition as some of those formulated in the new code recently issued. Owners and builders gave hearty support to all provisions making for the greater protection to life of crews or passengers, even though in some cases they bordered on the ridiculous, particularly as applied to the prevailing type of ship built on the great lakes. The builders and owners of the great lakes are entitled to more consideration and their opinions and experience given greater weight than any other section of the country, or for that matter than all other sections, seeing that they are putting more money into tonnage each year than all the rest of the United States, leaving, of course, naval construction out of consideration, and over this the steamboat inspection service has no jurisdiction.

We have had occasion heretofore to call attention to the provisions for fire protection, not only to their ambiguity which is in urgent need of clearing up, but to the utter lack of judgment shown in framing them. Section 8 of Rule IV is actually inferior to no rule whatever and only exhibits how a lack of engineering knowledge may be mischievous. No change has been made in this rule except to create a separate tonnage class for steamers of between 20 and 150 tons.

The features which will bring out the greatest opposition this year, however, are to be found in the rules relating to steam and feed pipes and boiler mountings.

What seem to be unmistakable evidences of the activity of some manufacturer are to be seen in abundance. For a number of years now, builders have been fitting out steamers which in these respects not only complied with all previous requirements, but exceeded them, and there has not been a serious accident reported nor a case of a ship or lives being endangered through the points referred to being in any way deficient. In fact, lake builders were many years in advance of the law in these respects and were using extra heavy pipe and fittings long before the laws made it compulsory, and many of the lines of steam goods now standard were called into existence by the demand of builders and owners for better material. The board did itself no credit in Section 20, Rule II, as now amended; the restrictions and conditions with which it is loaded show neither fairness nor good sense and no justification for its adoption exists or can be shown.

What the cost will be to owners, upon whom the losses entailed will ultimately fall, is not easy to say, in fact it would be difficult for the builder himself to say at this juncture. Under the rules as previously existing it was a matter of extreme difficulty to get material and builders carried large stocks amounting in one case we know of in the line of extra heavy valves alone to close on $30,000, practically all of which were made up specially for marine use and which are now useless, because the date fixed for the law to take effect, June 30, will not permit of reducing the stock materially. When to this is added the loss on other fittings and the impossibility of getting material to meet the requirements in the present condition of business, the rules practically put a stop to construction. An instance of the discretion exhibited is to be found in the clause which requires that all fittings over 2 in. diameter shall be permanently flanged.

Inasmuch as the rules allow of screwed flanges it merely means that a flanged elbow with two screwed flanges and two additional bolted gasket joints must be substituted for an extra heavy screwed elbow (or T as the case may be), simply making the condition worse than before.

Besides, Section 19, which says, "where such pipes are made of extra heavy lap welded steam pipe up to and including 5 in. diameter, the flanges may be attached with screw threads and all joints in bends may be made with good and substantial malleable iron elbows or equivalent material," stands just as it stood before, and as it was the clause under which all equipments in recent years have been installed it certainly conflicts with Section 20.

It is to be noted that the rules nowhere previous to 1907 call for the use of extra heavy fittings, but builders have been using them for years for the general betterment of the work. The rules are full of inconsistencies and conflicting clauses which space forbids quoting, but we cannot forbear our amusement at the way the board backs into the hole on the question of sling stays for combustion chamber crowns and endeavors to pull the hole in after it.

It is not at all probable that the rules as they stand can or will be enforced, and the least the Supervising Inspector General, through the Secretary of Commerce and Labor, can do, is to extend the operation of the 1906 rules until such time as the subject can be ventilated.

A project is on foot for the improvement of the harbor at Victoria, B. C., at a cost of about $1,000,000, the amount to be expended over a period of five years. The Canadian government is being petitioned to authorize the work.

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ORE ON DOCK MAY 1.

Statistics gathered from the various dock managers at Lake Erie ports show that the amount of ore on Lake Erie docks May 1 of the present year was 1,976,988 gross tons, as against 1,791,090 tons in 1906, an increase of 185,898 tons.

The total rail shipments from Lake Erie ports to furnaces during the winter season (Dec. 1 to May 1) aggregated 4,275,467 tons, viz.:

	Gross tons.
On dock Lake Erie ports, Dec. 1, 1906	6,252,455
On dock May 1, 1907	1,976,988
By rail to furnaces, winter of 1906-7	4,275,467

Adding these winter shipments to 25,824,302 tons, the amount shipped to furnaces during the navigation season of 1906 gives 30,099,769 tons, as the entire consumption of ore from Lake Erie ports during the year ended May 1, 1907, as against 28,984,358 tons for year ended May 1, 1906, as against 20,057,070 for the year ended May 1, 1905, as against 18,739,995 tons for the year ended May 1, 1904, 21,905,251 tons for the year ended May 1, 1903, 17,216,065 tons for the year ended May 1, 1902, 14,465,260 tons for the year ended May 1, 1901, 15,882,881 tons for the year ended May 1, 1900, 12,122,982 tons for the year ended May 1, 1899, and 10,209,488 tons for the year ended May 1, 1898. The following table gives the amount of ore in dock at the opening and closing of navigation for ten years past.

IRON ORE ON LAKE ERIE DOCKS—GROSS TONS.

Ports—	—Opening of Navigation— May 1, 1907.	May 1, 1906.	May 1, 1905.	—Close of Navigation— Dec. 1, 1906.	Dec. 1, 1905.	Dec. 1, 1904.
Toledo	147,397	52,550	71,642	281,000	368,024	318,573
Sandusky	5,439	29,320	44,444	17,467	52,977	75,134
Huron	98,106	80,728	68,100	245,499	208,023	182,495
Lorain	176,300	140,452	165,586	336,321	271,695	299,504
Cleveland	447,573	350,382	513,559	1,224,606	1,330,619	1,237,033
Fairport	154,246	266,162	390,869	590,783	759,961	660,420
Ashtabula	568,485	462,564	623,451	1,631,312	1,589,951	1,403,575
Conneaut	139,853	148,528	96,295	1,057,424	976,976	684,487
Erie	189,276	169,488	236,414	552,631	564,961	583,439
Buffalo	50,313	90,960	61,271	315,412	315,780	318,739
Total	1,976,988	1,791,090	2,271,631	6,252,455	6,438,967	5,763,399

A FIRM NAME BOUND UP IN THE LAKE MARINE.

References in a Cleveland paper of recent date to the wooden steamers John E. Pringle and Edward Smith serve to draw attention to the fact that the old Buffalo lumber firm of Gratwick, Smith & Fryer have probably furnished names for more lake craft than any other group of men who ever figured in lake history, or perhaps in any part of the world.

In 1880 the first W. H. Gratwick was built and in the same year her consort the schooner R. L. Fryer. In the year 1883 the first Edward Smith was built and in 1887 the second W. H. Gratwick, the first subsequently having her name changed to John C. Pringle. In 1888 the second R. L. Fryer, a steamer, was launched, and in 1891 the second Edward Smith. The two Smiths were known afterwards as Edward Smith No. 1 and Edward Smith No. 2 until the No. 2 was sold by the Mitchells to O. W. Blodgett and her name changed to Zillah. She is one of the best wooden boats on the lakes. In 1893 a third W. H. Gratwick was built (the name of the second being afterwards changed to Fleetwood), a steel vessel, all those previously mentioned having been of wood, and in 1902 the W. H. Gratwick, fourth of the name. The names seem to have brought good luck, all the ships originally built under them being still in commission.

It is not a little interesting, too, that all the wooden ships except the Gratwick 2nd received their engines from the old Frontier Iron Works of Detroit, a name that has long been linked with good work and satisfactory service, though now some years out of existence.

It is also noteworthy that all these ships have, either in his capacity as master or later as manager, been the pride of Capt. John Mitchell, and "Mitchell luck" has long been a proverb around the lakes.

IRON SITUATION.

After holding the center of the market as respects buying interest for the last several weeks, pig iron has become comparatively quiet, and finished lines have undergone a corresponding quickening in demand during the past week. A tendency toward higher prices is discernible owing to the scarcity of crude steel and increasing labor costs. This is shown in a striking manner in tool steel where prices on ordinary tool steel have been advanced $10 per ton, while in some cases on high speed steel the raise has amounted to $20 per ton. The National Tube Co. has announced an advance of $4 per ton on merchant pipe, which applies to business taken since March 8. While the buying of pig iron has not been so active, there is no weakness and the market is firm. Railroads were prominent as buyers during the week. Large rail sales have been closed, including 167,000 tons of open-hearth rails for the Harriman lines; 142,600 tons for the Pennsylvania; 28,000 tons for Pacific coast lines; 70,000 tons for the Chicago, Milwaukee & St. Paul, and 45,000 tons for the Burlington. Agricultural interests are buying more actively. The danger of a shortage of steel bars is imminent. Bar iron continues weak.

FREIGHT SITUATION.

Though the season is now fairly advanced vessels are not yet operating regularly owing to inclemency of weather in the Lake Superior country. Some of the ore carriers have not as yet made a trip in that trade, owners having generally figured on an early start and having placed their vessels in the grain trade for the first trip. The delay is a serious one and has thrown vessel owners behind on their contract ore. For this reason they are unable to enter the grain trade which will probably make for a better rate in this commodity later on.

The harbors of Fort William and Port Arthur have been blocked by ice since Sunday. At the last report there were eighteen steamers waiting to get in and about twenty were trying to get out. Certainly these are conditions making for great firmness in the market.

LAUNCH OF THE HENRY PHIPPS.

The steamer Henry Phipps was successfully launched at the Bay City yard of the American Ship Building Co. on Saturday last and was christened by Miss Irene Smith, daughter of Capt. W. W. Smith, marine superintendent of the Pittsburg Steamship Co., for whom the vessel is building. The Phipps is the third of the four 600-footers ordered by The Pittsburg Steam Ship Co. to be launched. The Phipps, like her sisters, is 600 ft. over all, 580-ft. keel, 58-ft. beam and 32 ft. deep. She will have triple-expansion engines with cylinders 24, 39 and 65-in. diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 16 ft. in diameter and 11½ ft. long. Capt. W. B. McGregor will sail the Phipps and E. H. Larned will be her chief engineer.

On the morning of May 9 fire broke out in the plant of the Falls Hollow Stay Bolt Co., while the mill was in operation. Considerable damage was done to a portion of the roof of the main building which did not, however, interfere with the operation of the plant to exceed 24 hours. The company announces that the fire is of little consequence and that the filling of orders will not be delayed.

The Hoquiam Ship Yard, Hoquiam, Wash., recently laid the keel of the steam schooner Shasta, to be built for the E. K. Wood Lumber Co.

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COMMERCE OF LAKE SUPERIOR

It has frequently been stated in the columns of the MARINE REVIEW that there is no adequate measure of the port to port commerce of the great lakes, and therefore no way of determining the total commerce of the great chain of waters. However, it is fair to assume that more than half of the commerce of the lakes passes through the canals at Sault Ste. Marie, and it is fortunate indeed that records at this point are very reliably kept by the officials in charge of the United States and Canadian canals. Supt. Louis C. Sabin has just submitted to Col. Charles E. L. B. Davis for transmission to the secretary of war the exhaustive report of canal commerce for 1906 that is known as the mile-ton report. The report shows that $36,666,889 was paid as carrying charges to vessels that moved 51,751,080 net tons of freight through the canals in 1906, and that the total value of freight was $537,462,454. The cost per ton per mile of moving this freight was 0.84 of a mill, as against 0.85 of a mill in 1905, 0.81 of a mill in 1904, 0.92 of a mill in 1903, and 0.89 of a mill in 1902.

The total freight traffic of 51,751,080 net tons for the season of 1906 when compared with the season of 1905 shows an increase of 17 per cent or 7,480,400 tons. The items showing an increase are coal, flour, wheat, grain other than wheat, manufactured and pig iron, salt, iron ore, copper and general merchandise. The total number of passengers was 63,033, an increase of 8,829 or 16 per cent. Vessel passages through both canals numbered 22,155, showing a gain of 476 or 2 per cent. The total lockages numbered 14,523, a gain of 731 or 5 per cent. The season of navigation continued for a period of 8 months and 9 days, during which time the average freight traffic was 6,235,070 net tons.

The traffic through the American canal was 87 per cent of the total freight and 49 per cent of the total number of passengers carried, the amounts being 45,180,292 tons of freight and 30,925 passengers. Compared with the season of 1905 there was an increase of 6,378,012 tons of freight or 16 per cent, and an increase of passengers of 2,524 or 9 per cent. The American canal opened April 13 and closed Dec. 17, 1906, making the length of the season 249 days.

The traffic through the Canadian canal was 13 per cent of the total freight, and 51 per cent of the passengers carried, the amounts being 6,570,788 tons of freight and 32,108 passengers. Compared with the season of 1905 there was an increase of 1,102,298 tons of freight or 20 per cent, and an increase of 6,305 passengers or 24 per cent. The Canadian canal was opened on April 14 and closed Dec. 22, 1906, making the length of the season 253 days. Following are some of the most interesting conclusions regarding the traffic of 1906:

Total freight carried, tons	51,751,080
Total net registered tons	41,098,324
Total mile tons	43,596,953,680
Total valuation placed on freight carried	$537,463,454
Total amount paid for freight transportation	$36,666,889
Total number of registered vessels using canals	879
Total number of passages by unregistered crafts carrying freight	810
Total valuation placed on registered vessels	$94,532,500
Total number of passengers transported	63,033
Average distance freight was carried, miles	842.4
Average cost per ton for freight transportation	$0.71
Average cost per mile per ton, mills	.84
Average value per ton of freight carried	$10.39
Time American canal was operated, days	249
Time Canadian canal was operated, days	253
Freight carried by—	
Registered vessels, tons	51,652,262
Unregistered vessels, tons	98,818
American vessels, per cent	95
Canadian vessels, per cent	5
Passengers carried by—	
American vessels, per cent	43
Canadian vessels, per cent	57
Average number of vessels passing per day—	
Through Poe lock	40
Weitzel lock	28
Canadian lock	22
Poe, Weitzel and Canadian locks	87

The number of registered vessels of 500 to 600 ft. in length using the canal in trade to and from Lake Superior was 57; of 400 to 500 ft. in length, 128; of 300 to 400 ft. in length, 172; of 200 to 300 ft. in length, 258; of 100 to 200 ft. in length, 184; and of less than 100 ft. in length, 80. The maximum freight traffic for a single day was on June 25 when 371,005 tons passed through the canals on 122 vessels, having an aggregate registered tonnage of 244,804. There were no passages on Dec. 20 and 21. Forty-four new vessels were put in commission for the Lake Superior trade in 1906. They were all steamships for freight traffic. Thirty-two of these new vessels are 500 ft. or more in length and carry from 9,000 to 14,000 net tons of freight in a single cargo. The largest single cargo carried through the canals in 1906 consisted of 13,272 tons on the steamer J. Pierpont Morgan. The greatest amount of freight carried was 313,434 tons by the steamer E. H. Gary. The greatest number of miles run were 42,986 by the steamer E. H. Gary, while the greatest number of mile-tons was 249,353,656, also by the steamer E. H. Gary. The following table will prove interesting as showing the distribution to other lakes of freight bound eastward from Lake Superior and also the district from which freight bound to Lake Superior originated:

EAST BOUND.

From Lake Superior ports to—	Net tons.
Lake Michigan ports	4,313,078
Lake Huron ports	1,231,936
Lake Erie ports	35,503,324
Lake Ontario ports	536,567
Total	41,584,905

WEST BOUND.

To Lake Superior ports from—	Net tons.
Lake Michigan ports	113,558
Lake Huron ports	452,116
Lake Erie ports	9,497,293
Lake Ontario ports	103,208
Total	10,166,175

COMPARATIVE STATEMENT OF COMMERCE THROUGH THE CANALS AT SAULT STE. MARIE, MICHIGAN AND ONTARIO, FOR THE SEASONS OF 1905 AND 1906.

Items.	Traffic for 1906. United States Canal.	Canadian Canal.	Total Traffic for Season 1906.	Season 1905.
Vessel Passages:				
Steamers ....Number	13,051	5,087	18,138	17,197
Sailing ....Number	2,607	210	2,817	3,263
Unregistered ....Number	817	383	1,200	1,219
Total....Number	16,475	5,689	22,155	21,679
Lockages ....Number	10,367	4,156	14,523	13,792
Tonnage:				
Registered ....Net	34,789,793	6,308,531	41,098,324	36,617,699
Freight ....Net	45,180,292	6,570,788	51,751,080	44,270,680
Passengers....Number	30,925	32,108	63,033	54,204
Coal:				
Hard ....Net tons	872,383	138,992	1,011,375	984,701
Soft ....Net tons	6,634,006	1,094,249	7,728,255	5,524,355
Flour ....Barrels	4,100,024	2,395,326	6,495,350	5,772,719
Wheat ....Bushels	49,977,831	34,293,527	84,271,358	68,321,288
Grain, other than Wheat....Bushels	37,661,898	16,681,257	54,343,155	39,229,553
Manufactured and Pig Iron....Net tons	304,321	86,784	391,105	237,696
Salt ....Barrels	371,680	96,482	468,162	423,122
Copper ....Net tons	99,572	8,061	107,633	106,520
Iron Ore ....Net tons	32,453,645	2,903,397	35,357,042	31,332,637
Lumber ....M. ft. B. M	854,167	46,464	900,631	966,806
Silver Ore ....Net tons	.....	.....	.....	41
Building Stone ....Net tons	6,222	.....	6,222	10,899
General Merchandise ....Net tons	541,895	592,956	1,134,851	836,583

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from Nine Mile Point to Presque isle I am not in favor of for this reason. In the vicinity of Presque isle, I think is the most dangerous place on the lakes, in a fog here the down bound would have to cross the bows of all up bound, both for Lake Michigan and Lake Superior.

In regard to your letter of April 20, the question of east and west course of navigating the lakes, for my part do not think it advisable as all masters in my opinion would always make for a weather shore either bound up or down if it is blowing hard and in case of fog or snow storm would naturally draw in to catch the sound of fog signal so as to find right location of their boats, for instance, a boat bound down Lake Huron with a strong northwest wind would keep up under the west shore and would make better weather and time and it would be easier on the boat.

SCIENTIFIC LAKE NAVIGATION

BY CLARENCE E. LONG

HOW TO GET AROUND IT.

To remove the difficulties of large deviations as found for the ship's head by compass instead of ship's head correct magnetic, as already explained, may be done by employing the Pelorus for taking the bearings in the following manner: Clamp the sight vanes to the correct magnetic bearing of the range; unclamp the dial so as to permit it to move freely with the sight vanes when they are moved, that is, both should swing together, the vanes being clamped to the dial and the dial unclamped from the rimmed disc that it works in. Then, just before the vessel is ready to cross the range keep the hair sight on the back object of the range as already explained, moving it slowly and evenly to keep it there as the vessel proceeds to close and bring the two objects of the range in one. At the instant that they are in transit read the course as shown by Pelorus, also the headings as shown by standard and steering compasses. The course as shown by the Pelorus will be the correct magnetic course that the vessel was heading on at the time she crossed the range. Then the difference between this correct magnetic course as shown by Pelorus and the course as shown by compass must be the deviation, and this deviation corresponds to the ship's head correct magnetic and not ship's head by compass. As this is what is required in every case this simple process does away entirely with Napier's diagram of compass deviations, in order to determine what the deviation would be were the ship to head correct magnetic instead of by compass, which is attracted by the ship's iron, and instead of the ship heading as indicated by compass, may not be within 4 or 5 points of it. This is the most serious difficulty with which the navigator has to deal in the use of his compass. Where the deviations are determined for different directions of the ship's head as indicated by compass and not by the ship's head herself; and where these deviations are large the application of the deviation corresponding to the correct magnetic course will only give an approximation (and hardly this in some cases) to the compass course, and it then becomes necessary to take the deviation corresponding to the approximate compass course and apply it to the correct magnetic course to obtain the compass course desired. Where deviations are very large it may be necessary to make several approximations before obtaining the desired compass course. As one can readily imagine, to do this, is a long and tedious job, requiring a great amount of figuring, besides many forms and operations to go through with.

A HANDY METHOD.

This method by Pelorus is handy and can be employed at any time; and recommends itself to favor from its extreme simplicity and comparative ease with which it is performed; not only this, but see the immense amount of labor that it does away with in the employment of rules, forms and figures in the plotting of the deviations as observed, drawing the curve to it, etc., all of which may tend to lead to error from the amount of figuring made necessary to arrive at results. The deviation as found for the ship's head correct magnetic relieves the whole operation, thus simplifying and abridging the confusing and tedious rules and methods in common use, for it is the ship's head correct magnetic that makes good the course as shown by compass.

THE DUMB CARD MUST SHOW IT.

It must be plain to see that if the sight vanes of the dumb card are so placed as to point out the correct magnetic bearing of the range when in transit (when the ship is in one with the range), the card must be pointing out the correct magnetic directions of the horizon, by means of the sight vanes kept to the range at time of transit, where the the fore-and-aft line meets the edge of the card must then be the correct magnetic course of the ship's head. Whatever difference that the other compasses show in comparison with this correct magnetic course at that time, is the deviation in each case.

Taking the same deviation observations as given in the Chicago example the work would stand as in the following table.

1 Ship's Head by Pelorus or Ship's Head Correct Magnetic.	2 Ship's Head by Standard Compass.	3 Deviation for Ship's Head Correct Mag. for Headings in 1st Column.
N 12° W	North	12° Wly
N 4 E	N by E	7¼ "
N 21 E	NNE	1½ "
N 37 E	NE by N	3¼ Ely
N 52 E	NE	7 "
N 66 E	NE by E	9¼ "
N 81 E	ENE	13½ "
N 94 E	E by N	15¼ "
N 106 E	East	16 "

And so on with every point of the compass.

To explain the foregoing. The first column represents the ship's head by Pelorus, that is, what the Pelorus reads when the ship crosses the range with the sight vanes kept to the correct magnetic bearing of the range at the time of crossing, and must therefore represent the ship's head correct magnetic when the standard compass was on the points as shown by column 2. The second column shows the course that the vessel was steering at the time the observations were taken; and the third column shows the deviation corresponding to the ship's head correct magnetic, as shown in column 1, and also the deviation according to the ship's head in column 2. But, what is required to know is the deviation corresponding to the ship's head correct magnetic, and although the deviation in the above table is the same for the ship's head correct magnetic in one case and the ship's head by compass in the other; for example, when the ship's head is north, as indicated by compass the Dev. is 12 degrees Wly, but when the vessel is heading north by compass, she is in reality heading N. 12 degrees W., according to the correct magnetic points of the horizon. Thus, we can see at once that the Dev. for north by compass will not answer for north correct magnetic; for on referring to column 1 it will be seen that correct magnetic north comes in somewhere between N. 12 degrees W. and N. 4 degrees E., and that the deviation falls between 12 degrees and 7¼ degrees. As we will soon see the Dev. corresponding to correct magnetic north equals 8½ degrees, so that by employing the Dev. corresponding to north as indi-

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cated by compass, a mistake of nearly 4 degrees would be made in the course.

TO GET IT ON THE EVEN POINTS.

What we then desire is a table of deviations corresponding to the even points of the compass with the ship's head correct magnetic instead of the ship's head by compass. This cannot be done by the process of Pelorus set to the correct magnetic bearing of the range, for the reason that it is impracticable to place the ship's head exactly on a full point by Pelorus, when the ship crosses the range for the simple reason that we do not know on which point it will come; but it can easily be determined by means of the following simple graphic method:

A SIMPLE GRAPHIC METHOD.

On a sheet of paper draw a vertical line down the center to represent the correct magnetic north and south points of the compass. Next adopt a scale of equal parts, say 1-16 of an inch to a degree (use a common foot rule); take the dividers and prick off 11¼ sixteenths, to represent the distance between points, and mark this off on the vertical line. By means of the parallel rulers draw horizontal lines through each one of these marks that stand for compass points, at exactly right angles to the vertical line. After you have divided and ruled these various lines, write in rotation the points of the compass. Then with the number of sixteenths of an inch that agrees with the number of degrees that the ship's head was from the full point next to it, or from the nearest cardinal point (see Fig. 36 for full information), prick off with dividers each correct magnetic direction of ship's head on which an observation was made.

HOW IT IS DONE.

Having determined these stations by pricking them off on the vertical line, draw horizontal lines through them in the same manner that you did the full points. Remember that these stations represent correct magnetic points of the compass. Next take from the Table of Dev. the amount of the Dev. corresponding to these various directions of the ship's head correct magnetic, and lay it off on each one of these horizontal lines, according to its amount and name—to the right of the vertical line if the Dev. is Ely., to the left if the Dev. is Wly. Thus, for example, take Fig. 36, which is an illustration of this process, and its data is the deviation observations taken off Chicago. The first correct magnetic course, acording to this table, is N. 12 degrees W., the Dev. corresponding to it being 12 degrees Wly. Take between the dividers 12 sixteenths of an inch, and prick it off on the vertical line from North, (upwards, because it is west of north), and draw a horizontal line through it; then with this same extent between the dividers lay off 12 sixteenths of an inch to represent the number of degrees of deviation for this heading; lay it off to the left because it is Wly. The next observation is for N. 4 degrees E. and the deviation corresponding to it is 7 degrees Wly. Take between the points of the dividers 4-16ths and lay it off from North toward East (downwards) and draw a horizontal line through it; next take 7-16ths between the dividers and lay this off on the horizontal line to the left of the vertical line because the Dev. is Wly. The next correct magnetic course on which an observation was taken is N. 21 degrees E., and the Dev. corresponding to it is 2 degrees Wly., which lay off in the same manner as already explained, and do the

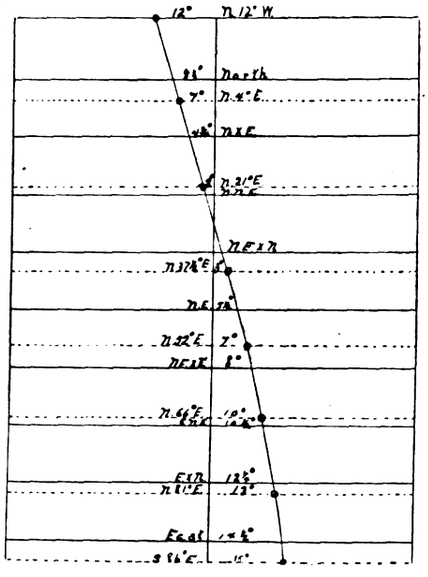

FIG. 36.

same with each of the other correct magnetic courses and the proper Dev. corresponding thereto. Remember that Ely deviations are laid off to the right of the vertical line. After completing the work of the Dev. draw a curve freely through the points marking these distances. Then to determine the Dev. corresponding to each full point merely measure from the full point to the curve on the horizontal line drawn through the full point, and the measure of sixteenths of an inch will give the number of degrees of deviation corresponding thereto. Thus, in Fig. 36, from North to the curve on the horizontal line is 8½ sixteenths, or 8½ degrees; on N. by E., 4¾ sixteenths, or 4¾ degrees, and so on. The Dev. as found for each full point of the compass should be tabulated as follows:

Ship's head correct magnetic.	Deviation.
North	8½° Wly.
N. by E.	4¾° "
NNE.	1¾° "
NE. by N.	2¼° Ely
NE.	5½° "
NE. by E.	8° "
ENE.	10½° "
E. by N.	12¼° "
East	14½° "
etc.	etc.

We now have the deviations corresponding to the ship's head correct magnetic for each even point, which completes the work. To determine the Dev. for the halves and quarters lying between the full points is performed in the same way as for the whole point.

A deviation curve is a handy and convenient device for handling this perplexing problem, for after the curve is once drawn it becomes an easy matter to compute and tabulate the deviations for any desired course or ship's head.

OTHER METHODS.

While the methods of determining the deviation "By the Known Correct Magnetic Bearing of a Distant Object," and "By Reciprocal Simultaneous Bearings of Two Compasses," are of little real and practical value on the lakes, due to our "hurry-up" navigation, and the length of time that would be consumed in performing the work by these methods, we will, nevertheless, explain their principles. It is well to know how to use them, for the navigator may be so situated that he can employ one or the other to the best of advantage.

DEV. BY THE KNOWN CORR. MAG. BEARING OF A DISTANT OBJECT.

First determine the correct magnetic bearing of the object to be employed by any method you deem best. This can be done by finding the ship's position by cross bearings of two objects, and plotting the ship's position on the chart, and then establishing the correct magnetic bearing by drawing a line from the ship's position through the object. This line transferred to a compass rose by means of the parallel ruler will give the true bearing, to which apply the variation.

TAKE THE COMPASS ON SHORE.

If this cannot be done then the compass may be carried on the shore and the ship's bearing taken. The bearing of the ship from the shore will evidently be the same as its correct magnetic bearing from the ship by that compass. For instance, supposing on shore there was a church with a lofty steeple, not given on the chart; the compass carried on the shore and set up in a direct line between the steeple and ship, must give the correct magnetic bearing of the steeple from the ship, or vice versa, for the

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compass on shore is not disturbed by the iron of the ship; care must be taken that no magnetic influence exists in the vicinity of the compass to attract it, or the work performed by it will be in error.

MUST BE FAR DISTANT.

It must be remembered that the object selected for the purpose of taking the bearings from must be at such a distance from the ship that the diameter of the space through which she revolves will make no sensible difference in its real bearing. If the ship is swinging to her anchors a well defined object from 6 to 8 miles distant will answer the purpose, but if a nearer object be used the bearing in each case will be affected by parallax, which in a case of this kind, may be defined as the difference in the bearings as seen from two different stations.

STEADY HER HEAD ON EVERY POINT.

The requisite means being prepared, the ship is to be gradually swung round so as to bring her head successively upon each of the thirty-two points, or directions, of the compass; and as her head approaches each of these points her motion should be gently checked. When the ship is quite steady and her head exactly on one point the direct bearing of the object is to be observed with the standard compass and registered according to the form shown in the first two columns of the accompanying specimen:

FORM FOR REGISTERING THE PROCESS BY DIRECT BEARING.

Correct magnetic bearing of Chimney from ship N. 82 degrees W., distant 7 miles.

1	2	3
Ship's head by Standard Compass.	Bearing of Chimney by the Standard Compass.	Deviation of the Standard Compass.
North	N 70° W	12° Wly
N by E	N 75 W	7 "
NNE	N 80 W	2 "
NE by N	N 85 W	3 Ely
NE	N 89 W	7 "
NE by E	N 91 W	9 "
ENE	N 95 W	13 "
E by N	N 97 W	15 "
East	N 98 W	16 "

And so on with every point of the compass.

The ship's head is to be gently brought round in the same manner to the next point and, when duly stopped and steadied there, the bearing of the same object is to be again set and again recorded, and so on, point after point, till the exact bearing of the one object has been ascertained with the ship's head on every separate or alternate point of the compass. Then the difference between the correct magnetic and compass bearings on each point will be the deviation.

Thus, the difference between N. 70 degrees W. and N. 82 degrees W. is 12 degrees and it is named Wly because the correct magnetic bearing (N. 82 degrees W.) is to the left of the compass bearing (N. 70 degrees W.). Compare each compass bearing with this same correct magnetic bearing, because this is really the compass bearing it would have from on board if the compass was not disturbed by the attraction of the iron in the ship. The difference between this correct magnetic bearing of the object and the bearing observed with the standard compass on board when the ship's head is on any particular point will show the deviation on that point which was caused by the ship's iron, or, in other words, the deviation of the standard compass according to the direction in which the ship's head was placed.

The deviations thus found are named Ely when the compass card is drawn to the right hand by the attraction of the ship's iron, and Wly when it is drawn to the left hand of the magnetic meridian. The employment of the terms Ely and Wly being precisely analogous to that of Ely and Wly variation.

TO DETERMINE THE DEVIATION BY THE BEARING OF A DISTANT OBJECT, THE CORRECT MAGNETIC BEARING BEING UNKNOWN.

This may generally be effected by taking the mean of all the observed bearings, or of four or more bearings observed on equi-distant points.

Take the bearings of the distant object on 8 equi-distant points; divide the sum of the bearings by 8; the result will be the (approximate) correct magnetic bearing. Then the difference between the correct magnetic and compass bearing on each point will be the deviation. Thus:

Ship's Head by Standard Compass.	Bearing of Distant Object by Standard Compass.
SE	N 98° W
South	N 94° W
SW	N 83° W
West	N 66° W
NW	N 58° W
North	N 70° W
NE	N 89° W
East	N 98° W

8)656°

N 82° W=correct Magnetic bearing.

Correct Magnetic Bearing.	Deviation.
N 82° W	16° Ely
"	12° "
"	1° "
"	16° Wly
"	24° "
"	12° "
"	7° Ely
"	16° "

The deviations thus obtained being laid down on Napier's diagram, the deviations on the other points of the compass can be obtained, as also the course to steer.

This method of determining the correct magnetic bearing by adding the compass bearings and dividing this sum by the number of observations taken, is theoretically correct, but not practically correct, for the reason that there is nearly always a small error of constant effect which does not vary either in name or amount, no matter what may be the direction of the ship's head. It may be regarded as a sort of compass index-error, and is due to one or other of several causes, such as errors of observation, want of symmetry in the disposition of neighboring masses of iron, needles not being truly parallel to the north and south line of the compass card, incorrect estimate of the variation, and a slightly misplaced lubber-line. There is another error that plays a prominent part in this matter, and is the result of magnetism, induced when the ship's head was on one point of the compass, being retained when her head is swung to some other point. It makes a difference which way the ship is swung, whether to the right or to the left (with or against the sun), being plus in one case and minus in the other. The value of these errors is greatest when the ship is swung quickest. We have already referred to this matter in this chapter (in the run from Chicago to Pt. Betsey when the compass did not settle to the course at once) and we will further explain it under Compass Adjustment.

Experience and theory, says Towson, have convinced us that a more satisfactory result might be obtained by a more simple process. Instead of adding the eight observed bearings together and dividing by 8, add together the bearings with the ship's head east and west, and divide the sum by 2:

$$\frac{98°+66°}{2} = 82°$$

In this case the two examples agree, but they will not in every case.

The latter method is founded on two reasons. First, because the deviations on all points of the compass, but east and west, are affected by the ship's heel, producing heeling error. But when the ship's head is either east or west there is no heeling error. Secondly, the error due to retained magnetism (from the fact that the ship's iron producing magnetism does not gain or depart with its magnetism at once, and varies according to circumstances). But, however, with the ship's head east or west the error due to retained magnetism is of an opposite name to the index error of the compass, and, therefore, cancel each other.

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AT HEAD OF THE LAKES.

Duluth, May 13.—The harbor here is continuing very active in the effort to compensate for the tardy opening although the mining of ore is far from being in full blast. Cold weather still prevails on the range with freezing temperatures every night so that much of the ore is frozen as it comes to the docks. On the other hand, the loading of coal at lower lake ports is delaying the arrival of boats at this end and the quantity of coal carried is lengthening the time consumed generally on the round trip. One mining company operating several mines whose ore is carried by associated vessel interests has had to resort to stocking ore at its shaft mines and to holding back work in open pit because of delays in handling coal cargoes. An idea of the amount of coal being handled can be gained from the receipts so far this season at the Duluth-Superior harbor which amount to 707,519 tons, of which 523,034 tons were received at Superior.

The effect of delays in completing the vessels now under construction is also being felt but it is expected that the end of May will see this year's shipments on even terms with last year. Boats have not had the use of No. 5 dock at Two Harbors up to this time, and will not until about June 1, added to which the usual troubles connected with operating a new coal dock now being experienced by the Duluth & Iron Range railroad are holding boats at Two Harbors longer than under ordinary circumstances. Particularly is this true of the Steel Corporation boats, a number of which are tied up there.

During the week from May 1 to May 7 docks made large gains in the shipment of ore and as the rain for which both mining and farming interests have been looking for to loosen up the ground has come it is probable that the expectation of record shipments will be realized providing a fair amount of good weather prevails. While wheat for July and September hit the dollar mark in Duluth today, the crop situation is not critical for farmers in this district claim that as good a crop as last year may still be raised with favorable conditions from now on. The ore shipment figures for the week May 1-7 are as follows: Duluth, 310,370 tons against 210,936 last year; Two Harbors, 212,182 tons against 218,269 tons in 1906; Superior, 193,257 tons against 112,738 tons in 1906. This means that on the 7th Duluth was 182,300 tons behind last year, Two Harbors 291,546 tons behind, and Superior 23,056 tons behind, an aggregate of 496,912 tons as compared with 670,778 tons a week ago. The interesting feature both in the figures of last week and this is the increased shipments from the Allouez docks this year as contrasted with a year ago.

The Pittsburg Steamship Co. has installed a whistle signaling system at Two Harbors for the convenience of its boats. A code has been prepared made up of long and short blasts which provides a certain signal for each boat. All of the company's boats run the Two Harbor course and when they arrive off of that point they blow the boats' signal which is repeated by the dock followed by blasts indicating whether the boat is to put in at Two Harbors or go to Duluth or Superior. If the boat goes to Two Harbors still other signals inform the boat captain at which dock and on which side his boat is to tie up. Heretofore boats coming into Two Harbors have had to come within hailing distance of the dock for orders.

An excellent performance was made at the Boston Coal Dock & Wharf Co. in unloading the Harvey D. Goulder last week, carrying 10,500 tons of Hocking three-quarters (bituminous) coal. In running into the slip the boat grounded and for half a day only two rigs could be used. For the balance of the time the six rigs were used completing the unloading in 20 hours and 35 minutes of actual working time or at the rate of 8½ tons a minute.

The rigs are two of the Wellman-Seaver-Morgan type and four of the Brown hoist and their record for the performance was a little better than 85 tons per rig per hour.

Considerable has been said about low water this spring and one report quoted captains as saying that at Ashland the level is all of a foot low. Boats at this port, however, are loading to 18 ft. 11 in. and a little more, and the only point that is being watched is at Sailors' Encampment in St. Marys river.

On Saturday last the steamer R. L. Ireland, wrecked off Ashland last fall and afterward towed to Duluth with great difficulty for repairs at the Superior shipyards, left here with her first cargo of ore, having been towed over to the dock from Superior the day previous.

AROUND THE GREAT LAKES.

The barge Yankee which sank at the B. & O. slip at Sandusky has been raised and towed to Johnson's Island for repairs.

The tug Kelderhouse which ran aground near Dunkirk, N. Y., has been abandoned by the underwriters as a total loss.

The steamer Joseph C. Gilchrist which was in collision with the steamer John Sherwin in the ice is being repaired at Buffalo.

The coal cargo of the barge Melvina which sprung a leak while being towed to St. Ignace, has been sold to S. C. McLouth of Marine City.

Wm. McCullough, of Port Huron, has been given contract for the removal of the machinery of the steamer Pilgrim on the beach near Port Huron.

The contract to raise the passenger steamer Mascotte, sunk at her dock at Hancock, has been given by the underwriters to the Reid Wrecking Co. of Sarnia.

The steamer Iron Age broke her rudder in the Detroit river while bound up with the schooner Cobb in tow. The steamer put in at Sandwich with the help of the tug Industry.

Work will be started next week by the government contractors in dredging the harbor of Ontonagon, Mich. The entrance to the harbor will be widened and several shoals removed.

Judge D. E. Haven has given a decision to Sudden & Christensen of San Francisco for $20,000 salvage for towing the disabled steamer City of Pueblo into port on Dec. 30, 1905.

A survey is being made by the government steamer Visitor of the channel to the C. H. & D. coal dock at Toledo. It is desired to enlarge the channel from 400 to 500 ft. in width and 21 ft. in depth.

The contract for the improvement of Manitowoc Harbor has been let to the Great Lakes Dredge & Dock Co., at a figure .7 per cent lower than the lowest bid received in the competitive bidding. This was $213,000 with only $200,000 available.

The Lake Shore Navigation Co. which will operate the steamer City of Cleveland between Cleveland, Toledo and Cedar Point this year, has arranged to dock the boat at J. M. Dewey & Co.'s dock at Toledo.

James Squires, of St. Clair, Mich., has purchased the steamer Oregon which has lain partly submerged in Menominee river at Milwaukee for nearly a year. After a general overhauling she will engage in the lumber trade.

As a result of the government taking possession of its Water street property at Sault Ste. Marie, the Kemp offices will be removed to the lower dock and the tug office will go to the old ferry dock on the Seymour estate.

The schooner S. B. Pomeroy is on the bottom of the Black river just north of the Lorain dry dock of the American Ship Building Co. She had taken on a load of 800 tons of soft coal at the B. & O. Whirly dock when she began to sink. The tug Harvey D. Goulder was summoned and towed her into shallow water.

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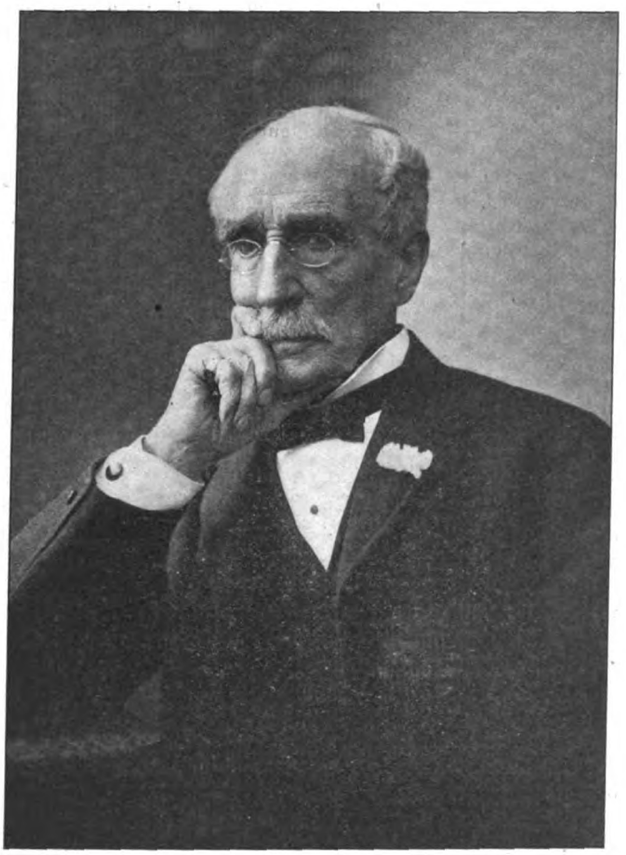
DEATH OF CHARLES HAYNES HASWELL.

Charles Haynes Haswell, the oldest civil engineer of note in the world, builder of the first steam launch and the most distinguished American expert in marine engineering, died at his home, No. 324 West Seventy-eighth street, New York, on Sunday last. He was in his ninety-rinth year. His life embraced the history of steam navigation for he was born while Fulton was conducting his experiments with the Clermont. He was nine years old when Napoleon was crushed at Waterloo and he was a practicing engineer of repute when Victoria



CHARLES HAYNES HASWELL

ascended the throne of Great Britain. Notwithstanding his great age he was never superannuated. Even as late as last November he participated in the proceedings of the Society of Naval Architects and Marine Engineers and the resolutions calling upon Congress to aid American shipping were amended by him in his own handwriting and were signed by him personally. His book, Mechanics and Engineers Pocket-Book, has been a standard work for over sixty years and he drew royalties on it up to the time of his death.

Charles H. Haswell was born of English parents in New York. He went to school until he was nineteen years old, when he entered the employ of James P. Allaire, proprietor of the largest steam engine building shop in the United States, and in 1836 he joined the United States navy as chief engineer, receiving his commission as engineer-in-chief in 1843. While in the navy, in 1837, he designed and constructed the first steam launch, the Sweetheart, which made her trial trip in the East river, watched by throngs of people from the shores.

He also designed the machinery for ten war vessels, and, after retiring from the navy in 1851, he built several merchant steamships, and designed various important engineering structures. In 1853 Emperor Nicholas gave him a diamond ring for professional service.

Mr. Haswell was the first to apply zinc in a steam boiler, and subsequently in the hold of a steamship to arrest the corrosive action of the salt water. This use of zinc, which was in 1847, was nearly thirty years previous to its trial in Great Britain as a new invention.

When the old Missouri was ordered home to Washington more than half a century ago, to test a novel design, a horizontal smoke pipe, Mr. Haswell, the chief engineer, would not believe that the scheme was practicable and that two pipes of three and one-half feet in diameter were equal in capacity to one of seven feet. He was accused of disrespect to his superior officer and suspended from duty. Upon the trial of the pipes, however, it was manifested that Haswell was correct, and he was told that as soon as the old pipe was restored the vessel would proceed to the Mediterranean, and that if he would apologize for his "insubordination" he would be restored to duty. He refused to apologize.

Soon afterward he was appointed to design and superintend the machinery for four revenue cutters and that of a steam sloop at Pittsburgh, Pa. In 1843 he was ordered to Washington to discharge the duties devolving upon the engineer-in-chief, who was officially ignored, and in 1845 he was promoted to that position, which he held until 1851, when President Fillmore appointed a civilian to supersede him, restoring to him his rank as senior chief engineer.

A professional feat of exceptional character was his design, in 1847-48, of the entire engine and boiler equipment of the United States steam frigate Powhatan. Owing to a lack of professional and clerical aid, and the urgent requirements of the service and the contractors, he was compelled to proceed with the design and details of both engines and boilers without a general design, and he personally designed every detail and made the working drawings with his own hands in the intervals between attention to necessary duties of his office as engineer-in-chief.

The design of the engines was novel in some parts, and wholly novel in the fact that they were set in wrought iron frames—the first construction of its kind. This feat is still unequalled in designing work of such magnitude.

In 1893 Mr. Haswell retired from the post of surveyor of steam vessels for the marine underwriters of New York, Boston, and Philadelphia. The buildings on Hoffman island, in New York harbor, were designed by him, as were the foundations of several large buildings in Manhattan, and he had been a consulting engineer of the city for many years. Besides writing various scientific treatises, he was the author of "Reminiscences of an Octogenarian of New York, 1816 to 1860." When he attended the convention of the Institution of Naval Architects of Great Britain in 1897, it was said that he was the oldest living engineer. At a later meeting of the same society, the chairman referred to him as having been an engineer in the United States navy when Queen Victoria ascended the British throne. Mr. Haswell was not present, but he had sent a paper on "Reminiscences of Early Marine Engine Construction and Navigation in the United States."

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COURT DECISIONS.

COLLISION.—The steamer Siemens, with a barge in tow on a line from 700 to 800 feet long, each loaded with 5,000 tons of ore, was passing down St. Mary's river, and when the tow was a half mile above the entrance to Little Rapids cut, the steamer North Star, also loaded, overtaking the barge signalled her intention to pass to port. The Siemens answered by a dissenting signal, and kept her course and speed which was 8 or 9 miles an hour. The North Star persisted, and, when a quarter of a mile from the cut again signalled, and the Siemens again dissented. A change of course to starboard was necessary to enter the cut, and, before the Siemens could make the turn with her tow and straighten out in the cut, a collision occurred between her and the North Star, which also entered the cut on her port side, and, as a result, a further collision occurred between the two steamers, and between the Siemens and her tow, the cut being but 300 feet wide. By the rules, it was lawful for an overtaking vessel to pass another above the cut, but it was not lawful for a vessel to proceed at a speed greater than 9 miles an hour or to overtake and pass another in the cut.

The circuit court of appeals for the second circuit held that the North Star was in fault, not only for violation of the positive rule as to speed, but for a reckless persistence when it was obvious at the time her first signal was answered that she could not pass before reaching the cut; that the Siemens was not in fault, it being her privilege under the rules to maintain her course and speed until she was overtaken, when, and not before, she was required by rule 5 of the secretary's rules to assent to the passing, and slacken to a slow rate of speed, and the situation being such when she received the first signal as to justify her in refusing to assent or to slacken her speed because of her tow.

GENERAL RULES AFFECTING LIABILITY FOR INJURIES BY VESSELS.—There is a general provision in the rules of navigation, that nothing therein contained shall exonerate any vessel, or the owner or master or crew thereof, from the consequences of the neglect of any precaution which may be required by the ordinary practice of seamen or by the special circumstances of the case. (Rule 28, Rules for Great Lakes.) Whenever danger of collision has become manifest, and the vessel previously bound to avoid it is plainly neglecting her duty to do so, the circumstances are special and the other vessel must do what she can to prevent disaster. Flagrant fault committed by one of the vessels will not excuse the other from adopting every reasonable and practicable precaution to prevent a collision.

Where a vessel is charged with having omitted to do something which ought to have been done, proof of three things is required: first, that it was clearly in the power of the vessel to have done the thing charged to have been omitted; secondly, that if done it would in all probability have prevented the collision; and, thirdly, that it was such an act as would have occurred to any officers of competent skill and experience. Whenever it appears that one of the vessels has neglected the usual and proper measures of precaution, the burden is upon her to show that the collision was not owing to her neglect, or that the other might nevertheless by ordinary care and skill have avoided the collision.

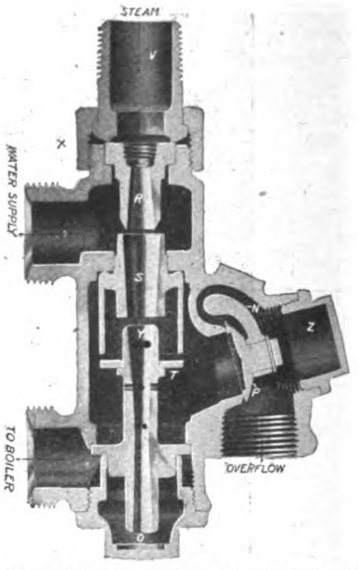
There is a general provision in all the rules (Rule 27, Rules for Great Lakes) that in obeying and construing the rules due regard shall be had to all dangers of navigation and collision and to any special circumstance which may render a departure from the rules necessary in order to avoid immediate danger. A departure from the general rules is, therefore, not only allowed in some cases, but it follows that when observance of a rule would plainly tend to bring about a collision, and departure from the rule would avoid it, departure becomes a duty. A vessel is in fault where a blind adherence to the rule that she shall keep her course necessarily results in a collision, which a change would probably have averted.

Departure from the rules of navigation is not favored by the courts, and exceptions are not to be lightly made; they are admitted with great caution, and only when imperatively required by the special circumstances of the case to avoid immediate danger, and then only to the extent that the danger demands. To excuse a departure from the rules there must be an actual necessity. Consideration of discretion and expediency, or mere apprehension of danger, or convenience will not suffice. It follows that under all ordinary circumstances a vessel discharges her full duty and obligation to another by a faithful and literal observance of the rules. It is no excuse for a violation of a rule of navigation either that it was not known or is not generally observed; or that the vessel was embarrassed by proximity to other vessels, where there is no justification for being in such proximity.

PENBERTHY AUTOMATIC INJECTOR.

The "Penberthy" automatic injector is a perfect re-starting automatic machine. By this we mean that when the injector is working, if the current of water be suddenly interrupted as is liable to happen from a sudden jar or jolt (on such apparatus as traction engines or road rollers or in the case of a marine boiler by the rolling of the vessel) this injector will automatically re-establish the current without attention from the attendant.

This is one of the features that has



SECTIONAL VIEW OF THE PENBERTHY AUTOMATIC INJECTOR.

given the "Penberthy" such a hold among marine engineers and traction and threshing engine manufacturers of the United States.

The "Penberthy" is so constructed as to have but few wearing parts and will last for years with proper care without renewals. All parts are interchangeable, however, when required. The Penberthy Injector Co., of Detroit, Mich., are pioneers and the largest manufacturers of automatic injectors in the world. Their steadily increasing business necessitating frequent enlargements of their already immense plant, is a fitting testimonial to the merits of their output.

The steamer Capt. A. F. Lucas, with the Standard Oil barge No. 95 in tow, has left the port of Philadelphia for London. This is the third attempt to tow a barge across the ocean but the trip is largely in the way of an experiment as to whether or not the towing of barges in the trans-Atlantic trade is practicable. The two cargoes aggregated 4,000,000 gallons of refined petroleum in bulk.

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